

Claims

What is claimed is:

- 1 **1.** A keep-warm system for a fuel cell power plant **(10)**,
2 comprising:
- 3 a. a fuel cell stack assembly (CSA) **(12)**
4 including an anode **(16)**, a cathode **(18)**, an
5 electrolyte **(14)**, and a cooler **(20)**;
- 6 b. fuel supply means **(25)** for providing a supply
7 of fuel, at least some of the fuel being supplied as
8 reactant to the anode **(16)**;
- 9 c. a source of oxidant reactant **(22)** operatively
10 supplied to the cathode **(18)**;
- 11 d. a water management system **(30, 28)**
12 operatively connected to the cooler **(20)** of the CSA
13 **(12)**;
- 14 e. thermal insulating means **(64)** enclosing at
15 least one of the CSA **(12)** and the water management
16 system **(30, 28)** for providing thermal insulation
17 thereof; and
- 18 f. catalytic fuel burner means **(66)**
19 operatively connected to the fuel supply means **(25)**
20 and to the source of oxidant reactant **(22)** for
21 catalytically reacting the fuel and oxidant and
22 providing a source of heat, the burner means **(66)**
23 being disposed and operative to supply heated gas into
24 the thermal insulating enclosure means **(64)**, and to the
25 at least one of the CSA **(12)** and the water management
26 system **(30, 28)** in the thermal insulating enclosure
27 means **(64)**.
- 1 **2.** The keep-warm system of claim 1 wherein the
2 catalytic burner means **(66)** includes a catalytic
3 surface **(72)** for combustively reacting the fuel in the

4 presence of oxidant in a flameless manner to release
5 heat only in a thermal range less than about 1000⁰ F.

1 **3.** The keep-warm system of claim **2** wherein the heat
2 released by catalytic combustion at the catalytic
3 burner means **(66)** is in the thermal range of about
4 200⁰-700⁰ F.

1 **4.** The keep-warm system of claim **2** wherein the source
2 of oxidant reactant **(22)** is ambient air, the air being
3 supplied to the catalytic burner means **(66)** and mixed
4 with fuel from the fuel supply means **(25)** for
5 combustively reacting the mixture in the presence of
6 the catalytic surface **(72)** to release heat.

1 **5.** The keep-warm system of claim **1** wherein the fuel
2 supply means **(25)** comprises a container of hydrogen
3 stored under pressure.

1 **6.** The keep-warm system of claim **1** wherein both the CSA
2 **(12)** and the water management system **(28, 30)** are
3 substantially enclosed by the thermal insulating means
4 **(64)**.

1 **7.** The keep-warm system of claim **4** wherein the
2 electrolyte **(14)** of the CSA **(12)** is a proton exchange
3 membrane (PEM), the fuel from the fuel supply means
4 **(25)** is hydrogen, and the heat released by catalytic
5 combustion at the catalytic burner means **(66)** is in
6 the thermal range of about 200⁰ - 700⁰ F.

7
1 **8.** In a fuel cell power plant **(10)** having a fuel cell
2 stack assembly (CSA) **(12)** including an anode **(16)**, a
3 cathode **(18)**, an electrolyte **(14)**, and a cooler **(20)**, a
4 fuel supply **(25)** for providing fuel to at least the

5 anode (16), a source of oxidant reactant (22) for
6 supplying at least the cathode (18), and a water
7 management system (30, 28) operatively connected to the
8 cooler (20) of the CSA (12), the method of preventing
9 freezing of water in freeze-sensitive parts of the fuel
10 cell power plant (10) during shutdown, comprising the
11 steps of:

12 a. selectively flowing (62, 63, 69, 67) fuel (25)
13 and oxidant (22) to a catalytic fuel burner (66) during
14 shutdown for catalytic combustion to provide heated
15 gas;

16 b. convectively flowing the heated gas into heat
17 transfer relation with the freeze-sensitive parts of
18 the fuel cell power plant (10) to provide heat thereto;
19 and

20 c. thermally insulating the freeze-sensitive
21 parts of the fuel cell power plant (10) including the
22 heated gas flowing in heat transfer relation therewith.